Editor's Notes & Ethics Statement

The IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI'21) jointly organised with the 17th IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN'21) of the IEEE Engineering in Medicine and Biology Society hosted an electronic paper submission process for the conference. It was the responsibility of the submitting Author to ensure the document was viewable and without errors that would prevent the Conference from including the paper in the Digital Proceedings or Website. In the event a paper was submitted that could not be viewed or printed properly, the Conference elected to only publish the abstract of the paper in the Proceedings. All conference papers were peer-reviewed by experts chosen by the BHI/BSN Conference Editorial Board for all contributed and Special Session papers.

The EMBS AdCom approved the following Code of Ethics to provide a guideline of ethical consideration for all members and to establish its support for ethical conduct in research.

Patients and Human Subjects
1. Respect human dignity and privacy of patients and human subjects.

Information
2. Ensure proper safeguarding of all confidential information, including information pertinent to patients, subjects, commercial entities, and trade secrets.

Environment
3. Promote a culture of cost-effectiveness.
4. Support the preservation of a healthy environment.

Research
5. Engage in research aimed at advancing the contribution of science and technology to improving healthcare provision.
6. Report research results with scientific integrity and proper due credit.
7. Observe the rights of human research subjects and strive for a balance between benefits and potential harm.
8. Ensure a responsible and humane use of animals in research.
9. Conduct clinical research studies in accordance with Good Laboratory Practices (GLP) and Good Clinical Practices (GCP).

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Welcome Letter

Dear Colleagues:

On behalf of the Organizing Committee, we are honored and delighted to welcome you to two flagship conferences of the IEEE Engineering in Medicine and Biology Society (EMBS), the **IEEE-EMBS International Conference of Biomedical and Health Informatics (BHI 2021)** and the **IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks** (**BSN 2021**). This is the 3rd time that these two conferences are co-organized with the vision that jointly, they provide a better forum for exchanging exciting ideas and advances in the field of digital health.

Due to COVID-19, this year the two conferences are held as virtual events. As we prepared the conference program, we looked at this format - forced upon us by the pandemic - as a challenge that motivated us to assemble an outstanding program. In addition, we put a great deal of effort toward attracting more attendees than in the past, so as not only to keep in touch with our colleagues who regularly attend the BHI and BSN meetings, but also to reach out to others in the field. We are delighted to see you joining our virtual conferences on July 27-30, 2021 https://www.bhi-bsn-2021.org/.

Biomedical and Health Informatics **(BHI)** encompasses methods and systems that allow one to collect and analyze data with the objective of deriving information relevant to health, healthcare, life sciences, and medicine. After a series of successful meetings in Hong Kong (Asia), Valencia (Spain), as well as Las Vegas, Orlando and Chicago (US), in 2021 a virtual platform will provide the opportunity to members from around the world to participate in a meeting that we are confident will be as stimulating as an in-person meeting.

The theme of **BHI2021** is: "*Reshaping healthcare through advanced AI-enabled health informatics for a better quality of life*". **BHI 2021** has oral and poster sessions on topics that include: **bioinformatics; imaging informatics; biomedical signal processing informatics; sensor informatics; behavioral informatics; big data analytics; machine learning and deep learning; clinical informatics; public health informatics; precision medicine informatics;** and **disease oriented informatics**.

After a successful series of **Wearable and Implantable Body Sensor Networks (BSN)** meetings held at Imperial College London, MIT Media Lab, RWTH Aachen, CU Hong Kong, UC Berkeley, Singapore NUS, UT Dallas, ICL London, MIT Lincoln Lab, ETH Zurich, MIT, UC San Francisco, Philips Eindhoven, Las Vegas and Chicago, in 2021 a virtual platform will provide the opportunity to members of the BSN community from around the world to participate in an exciting meeting where the latest advances in wearable and implantable body sensors will be presented.

BSN 2021 has focus on *wearable as well as implantable sensors and systems to monitor patients' health status*. BSN 2021 has oral and poster sessions on topics that include: **prototyping of body-worn, ingestible and implantable sensor networks; novel chemical, biological and textile body sensors; flexible and/or stretchable electronic sensors and systems; ultra-low-power or battery-less solutions for longitudinal studies; machine learning, deep learning and decision support algorithms; body area communication protocols, models and theories; security, privacy and trust in body sensor network;** and **medical/wellness applications from pre-natal health to elderly care**.

This year, the technical program committee of **BHI 2021** and **BSN 2021** have co-organized **9 workshops** on innovative research areas such as:

- assessing credibility of in silico trials for regulatory purposes,
- trends, challenges, and opportunities for the hospital of the future,
- big data and artificial intelligence in cancer imaging,
- integrating gender perspective in science, technology and innovation,
- machine learning based decision support system for early-stage prediction of complications and risk stratification of COVID 19 patients,
- AI4US: unlocking the potential of artificial intelligence for ultrasound image processing,
- real-world digital mobility assessment,
- soldier digital phenotyping, and
- predicting quality of life with multimodal data.

In addition, the **BHI-BSN 2021** program includes the following:

Seven (7) distinguished plenary keynote speakers from academia and the corporate world who will share their insights and accomplishments as well as their vision for future of the field.

Three (3) panels on the following topics:

- "clinical/translational panel"
- "Industry panel"
- "Regulatory issues for medical devices"

Furthermore, we have done the following to promote knowledge sharing, innovation, and networking among conference attendees:

1. all the papers and posters complying with the conference guidelines are eligible for the "Best Paper" and "Best Poster" selection ;
2. the authors of selected papers presented at the two conferences will have the opportunity to submit a full paper (with a publication fee waiver) to one of two flagship journals of the IEEE Engineering in Medicine and Biology Society: the *IEEE Journal of Biomedical and Health Informatics* and the *IEEE Open Journal of Engineering in Medicine and Biology*;
3. accepted four-page papers will be published in IEEE Xplore
4. all accepted 1-page papers will be included in the online digital proceedings

We want to express our deepest appreciation to all the members of the **BHI-BSN** steering committee, **BHI 2021**and **BSN 2021** organizing committees and technical program committees, the associate editors, as well as all the reviewers for their dedication and hard work in creating an excellent scientific program. We want to thank all the authors who submitted their papers for presentation at the meeting, and all of you for being here to take part in BHI-BSN 2021 and share your work.

We look forward to meeting you all during this exciting and memorable event!

Dimitris I. Fotiadis, BHI Chair
Paolo Bonato, BSN Chair

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Program at a Glance

Tuesday, July 27, 2021 Workshops				
	Virtual Room 1	**Virtual Room 2**	**Virtual Room 3**	**Virtual Room 4**
TIME (CET)	Workshop Sessions: 13:00 - 18:15 (CET)			
13:00 - 14:15	**Trends, challenges and opportunities for the Hospital of the Future** **Organisers:** Maria Teresa Arredondo & Giuseppe Fico,Universidad Politécnica de Madrid	**Big Data and Artificial Intelligence in Cancer Imaging** **Organisers:** Karim Lekadir, Universitat de Barcelona; Luis Martí-Bonmatí, La Fe University; Manolis Tsiknakis, FORTH; Gianna Tsakou, Athens R&D Lab of Maggioli S.P.A.	**Real-world Digital Mobility Assessment** **Organisers:** Andrea Cereatti, Politecnico di Torino; Silvia Del Din, Newcastle University; Felix Kluge, Friedrich-Alexander University Erlangen-Nürnberg	**Soldier Digital Phenotyping** **Organisers:** Karl E. Friedl & Reed W. Hoyt, U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts
14:15 – 14:20	**Break**			
14:20 – 15:35	**Trends, challenges and opportunities for the Hospital of the Future** **Organisers:** Maria Teresa Arredondo & Giuseppe Fico,Universidad Politécnica de Madrid	**Big Data and Artificial Intelligence in Cancer Imaging** **Organisers:** Karim Lekadir, Universitat de Barcelona; Luis Martí-Bonmatí, La Fe University; Manolis Tsiknakis, FORTH; Gianna Tsakou, Athens R&D Lab of Maggioli S.P.A.	**Real-world Digital Mobility Assessment** **Organisers:** Andrea Cereatti, Politecnico di Torino; Silvia Del Din, Newcastle University; Felix Kluge, Friedrich-Alexander University Erlangen-Nürnberg	**Soldier Digital Phenotyping** **Organisers:** Karl E. Friedl & Reed W. Hoyt, U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts
15:35 – 15:40	**Break**			
15:40 – 16:55	**Assessing Credibility of in Silico Trials for Regulatory Purposes** **Organisers:** Marco Viceconti, University of Bologna; Liesbet Geris, University of Liege	**AI4US: Unlocking the Potential of Artificial Intelligence for Ultrasound image processing** **Organisers:** Sara Moccia, Scuola Superiore Sant'Anna; Emilio Filippucci, "Carlo Urbani" Hospital; Maria Chiara Fiorentino, Università Politecnica delle Marche; Emanuele Frontoni, Università Politecnica delle Marche	**Predicting Quality of Life with Multimodal Data** **Organisers:** Valeria De Luca, Novartis Institutes for Biomedical Research; Ieuan Clay, Evidation Health	**Integrating Gender perspective in Science, Technology and Innovation** **Organisers**: Maria Fernanda Cabrera-Umpierrez, Universidad Politecnica de Madrid; Yolanda Ursa, INMARK
16:55 – 17:00	**Break**			
17:00 – 18:15	**Assessing Credibility of in Silico Trials for Regulatory Purposes** **Organisers:** Marco Viceconti, University of Bologna; Liesbet Geris, University of Liege	**Machine Learning based Decision support systems for early-stage Prediction of Complications and Risk stratification of COVID 19 Patients** **Organisers:** Luca Romeo, Michele Bernardini, Emanuele Frontoni, Università Politecnica delle Marche, Ancona; Jonathan Montomoli, Hospital Infermi; Maggie Cheng, Illinois Institute of Technology; Farshad Firouzi, Duke University	**Predicting Quality of Life with Multimodal Data** **Organisers:** Valeria De Luca, Novartis Institutes for Biomedical Research; Ieuan Clay, Evidation Health	**Integrating Gender perspective in Science, Technology and Innovation** **Organisers**: Maria Fernanda Cabrera-Umpierrez, Universidad Politecnica de Madrid; Yolanda Ursa, INMARK

Program at a Glance

Wednesday, July 28, 2021 Schedule				
TIME (CET)	Conference Sessions: 12:30 - 19:35 (CET)			
12:30-13:00	**Poster Session # 1** **Chair:** Misha Pavel (Northeastern University)			
13:00-14:00	**BHI Special Session** **Leveraging big data, machine learning and computable knowledge technologies to build learning health systems** **Chairs:** Guilan Kong (Peking University); Allen Flynn (University of Michigan)	**BHI Special Session** **Contactless Vital Signs Monitoring for AI Healthcare** **Chairs**: Wenjin Wang (Philips Research, Eindhoven University of Technology); Xuyu Wang (California State University)	**BSN Special Session** **Digital Biomarkers for Movement Disorders** **Chair:** Federico Parisi (Harvard Medical School)	**BSN Special Session** **Body-interfaced Flexible Sensors and Actuators: recent developments, challenges and opportunities** **Chair:** Hongliang Ren, (CUHK (HK) & NUS (SG))
14:00-15:00	**BHI Special Session** **Advanced Sensing and Computing Techniques for Sleep Monitoring** **Chairs**: Wei Chen (Fudan University); Amara Amara (Geneva University)	**BHI Session** **AI and Big Data Analytics (I)** **Chairs:** George Matsopoulos (National Technical University of Athens), Amira S. Ashour (Tanta University)	**BSN Special Session** **Body Sensor Networks in the era of pandemic** **Chair:** Raffaele Gravina (University of Calabria)	**BSN Session** **Monitoring Pulmonary Function Using Wearable Technology** **Chair:** Canan Dagdeviren (Massachusetts Institute of Technology); Ivan Lee (University of Massachusetts Amherst)
15:00-15:05	**Opening Welcome** **Chairs:** Metin AkayEMBS President, University of Houston; Dimitrios I. Fotiadis (JBHI EiC, University of Ioannina/ FORTH), Paolo Bonato (Harvard Medical School)			
15:05-15:35	**Keynote Lecture:** **"Wearable "SUPER-MINDS" for the Precision Control of CVDs and COVIDs"** **Yuan-Ting Zhang,** Hong Kong Center for Cerebro-cardiovascular Health Engineering (COCHE), HK Chair: Carmen Poon (GMed IT Ltd)			
15:35-16:00	**BHI-BSN Roadmap:** The Celebration **Chair: May D. Wang**, Georgia Tech and Emory University **Guests**: **Metin Akay**, EMBS President, University of Houston, USA; **Paolo Bonato,** Harvard Medical School, USA; **Dimitrios I. Fotiadis,** JBHI EiC, University of Ioannina/ FORTH, Greece; **Andrew Laine**, EMBS Past President; **Benny Lo,** BSN Past Chair, Imperial College of London, UK; **Jeff Palmer**, BSN-TC Chair, MIT Lincoln Lab, USA; **Stephen Wong**, BHI-TC Past Chair; **Yuan-Ting Zhang**, JBHI Past EiC, BHI Conf. Past Chair			
16:00-16:25	**Keynote Lecture:** **"Simplifying interpretation and acquisition of ultrasound scans"** **Alison Noble,** University of Oxford, UK Chair: Georgia Tourassi (Oak Ridge National), USA			
16:25-16:30	**Break**			
16:30-17:30	**Clinical/Translational panel** **Topic: "Advances and Trends in use of Informatics in Clinical Practice"** **Chair: Athanasios Tzioufas**, National and Kapodistrian University of Athens, Greece **Guests**: **Maria Teresa Arredondo**, Universidad Politécnica de Madrid, Spain; **Doris Bamiou,** University College of London, UK**; Elazer R. Edelman**, MIT, US; **Norbert Graf**, University of the Saarland, Germany; **Peter Stone**, Harvard Medical School, US			
17:30-18:00	**Featured Session** **Topic: "Pandemic Mitigation by Modeling and Informatics: Lesson Learned from COVID-19"** **Chair: Constantinos S. Pattichis,** Univ. of Cyprus, Cyprus **Featured Speakers: George Panos**, University of Cyprus & Nicosia General Hospital Internal Medicine Clinic, Cyprus; **Joshua S Weitz,** Georgia Institute of Technology, USA			
18:00-18:05	**Break**			
18:05-19:05	**BHI Special Session** **Opportunities for Machine Learning and Noninvasive Sensing to Impact Emergency Cardiovascular Care** **Chairs:** Omer T. Inan (Georgia Institute of Technology); Jin-Oh Hahn (University of Maryland); Jacob Kimball (Georgia Institute of Technology)	**BHI Session** **AI and Big Data Analytics (II)** **Chairs:** George Matsopoulos (National Technical University of Athens), Amira S. Ashour (Tanta University)	**BSN Special Session** **Body Sensor Network for Tele-Health Monitoring and Coaching** **Chair:** Bobak Mortazavi (Texas A&M University)	**BSN Session** **Machine Learning for the Analysis of Wearable Sensor Data** **Chairs:** Benny Lo (Imperial College London); Rita Paradiso (Smartex s.r.l.)
19:05-19:35	**Poster Session # 2**			

Program at a Glance

Thursday, July 29, 2021 Schedule				
TIME (CET)	Conference Sessions: 12:30 - 19:00 (CET)			
12:30-13:00	**Poster Session # 3** **Chair:** Paolo De Carvalho (University of Coimbra)			
13:00-14:00	**BHI Special Session** ***In silico* clinical trials: AI and biomechanical modeling of heart disease** **Chair:** Nenad Filipovic (University of Kragujevac)	**BHI Session** **Biomedical Signal Processing and Disease Oriented Informatics** **Chairs**: Winston Wu (Pharmaco-Kinesis Corporation); Zhiqiang Zhang (University of Leeds)	**BSN Special Session** **Advancements in Sensors, Algorithms and Clinical Trials for Non-invasive and Cuffless Blood Pressure Monitoring** **Chair:** Yali Zheng (Shenzhen Technology University)	**BSN Session** **Medical and Wellness Applications** **Chairs:** Christina Chase (Massachusetts Institute of Technology); Giancarlo Fortino (University of Calabria)
14:00-14:30	**Keynote Lecture:** **"Improving Consideration of Social and Cognitive Behaviors in Advancing Informatics Technologies for Health Care"** **Vimla L Patel**, Center for Cognitive Studies in Medicine and Public Health at the New York Academy of Medicine, US Chair: Daniela Giordano (University of Catania)			
14:30-15:00	**Keynote Lecture:** **"Soft, Wearable Systems with Integrated Microfluidics and Biosensors for Remote Health Monitoring"** **Roozbeh Ghaffari**, Northwestern University, USA Chair: Omer Inan (Georgia Tech), USA			
15:00-15:05	**Break**			
15:05-16:05	**Regulatory panel** **Topic: "Regulatory issues for medical devices panel"** **Chair: Nenad Filipovic,** University of Kragujevac, Serbia **Guests: Kevin Fu**, US FDA Acting Director for Medical Device Cybersecurity; **Andreas Melzer,** University of Leipzig, Germany; **Nick Petrick**, OHT7: Office of In Vitro Diagnostics and Radiological Health; **Yiannos Tolias**, Legal Lead AI and AI liability in healthcare, European Commission, Belgium			
16:05-16:10	**Break**			
16:10-17:10	**BHI Special Session** **Personalized Dietary Informatics for Precision Nutrition** **Chairs:** Edward Sazonov (The University of Alabama); Oliver Amft (Friedrich Alexander University Erlangen-Nuremberg (FAU); Benny Lo (Imperial College London)	**BHI Special Session** **Sensor-based behavioral informatics in support of Health Management and Care** **Chairs:** Manolis Tsiknakis (Foundation for Research and Technology – Hellas); Nikolaos Tachos (University of Ioannina)	**BSN Special Session** **Non-Contact Technologies for Pervasive Healthcare** **Chair:** Sarah Sun, (Michigan Technological University)	**BSN Special Session** **Digital Biomarkers for Monitoring and Predicting Upper Limb Recovery After Stroke** **Chair:** Christoph M. Kanzler (Singapore-ETH Centre and ETH Zurich)
17:10-18:10	**BHI Session Bioinformatics** **Chairs**: Barbara Di Camillo (University of Padova), Konstantinos Marias (Hellenic Mediterranean University and Foundation for Research & Technology Hellas)	**BHI Special Session** **AI-driven Informatics and Technologies for Cardiovascular Care using multi-modal data from EMRs and/or Wearables** **Chairs:** Bobak Mortazavi (Texas A&M University); Wenyao Xu (University at Buffalo)	**BSN Special Session** **New Technologies for the Future of Prenatal Health** **Chair:** Julien Penders (Bloomlife)	**BSN Special Session** **Wearable solutions for continuous, efficient and accurate lung monitoring for innovative diagnostics in lung related chronic diseases** **Chair:** Rita Paradiso (Smartex S.r.l.)
18:10-18:40	**Poster Session # 4** **Chair:** Ivan lee (University of Massachusetts Amherst)			

Program at a Glance

Friday, July 30, 2021 Schedule				
TIME (CET)	Conference Sessions: 12:30 - 19:00 (CET)			
12:30-13:00	**Poster Session # 5** **Chair:** Shyamal Patel (Oura Health)			
13:00-14:00	**BHI Special Session** **Real World Data analytics supporting High Value Care** **Chairs:** Fernando Seoane (Karolinska Institutet); Vicente Traver (Universitat Politècnica de Valencia)	**BHI Session** **Sensor Informatics and Machine Learning** **Chairs:** Themis Exarchos (Ionian Univ), Fahmi Khalifa (Mansoura University)	**BSN Special Session** **Wearable Sensing for Detecting and Monitoring Shock** **Chair:** Brian Telfer (MIT Lincoln Laboratory)	**BSN Session** **Novel Sensing Solutions for Long-Term Monitoring** **Chairs:** Valeria De Luca (Novartis); Jeffrey Palmer (MIT Lincoln Laboratory)
14:00-14:30	**Keynote Lecture:** **"Digital Health Technology – leveraging real-world insights in mobility"** **Lynn Rochester**, Newcastle University, UK Chair: Paolo Bonato (Harvard Medical School), USA			
14:30-15:00	**Keynote Lecture**: **"Leveraging Electronic Health Records for Precision Health"** **Marylyn D. Ritchie,** University of Pennsylvania School of Medicine, USA Chair: Benny Lo (Imperial College London), UK			
15:00-15:05	**Break**			
15:05-16:05	**Industry panel** **Topic**: **"The Evolution of AI products/services in medical informatics"** **Chair: Julien Penders,** Bloomlife, USA **Guests: Ilkka Korhonen,** CTO at Firstbeat Technologies, Tampere Area, Finland; **Christine Miyachi**, IEEE Future Directions Committee Chair and Nuance Communications, USA; **Andreas Persidis**, Biovista, Greece; **Ming Jack Po**, Ansible Health, USA; **Hosain Rahman**, Jawbone Health, USA			
16:05-16:10	**Break**			
16:10-17:10	**BHI Special Session** **Mobile Digital Solutions in Patient Care** **Chairs:** Galina Ivanova (University of Leipzig, Medical Faculty, ICCAS); Georgios Raptis OTH Regensburg, University of Applied Sciences)	**BHI Session** **Imaging Informatics** **Chairs**: Ehsan Adeli, (Stanford University); Huazhu Fu (Inception Institute of Artificial Intelligence)	**BSN Special Session** **Recent Advances in Wearable and Implantable Electronics and Circuits** **Chairs**: Wen Li (Michigan State University); Yaoyao Jia (North Carolina State University)	**BSN Special Session** **Toward Artificial General Intelligence for Wearable Systems** **Chair:** Hassan Ghasemzadeh (Washington State University)
17:10-18:10	**BHI Special Session** **Healthcare Analytics. Improving Healthcare outcomes using Multimedia Big Data Analytics** **Chairs:** Imran Razzak (Deakin University); Guandong Xu, (University of Technology, Sydney); Peter Eklund (Deakin University)	**BHI Special Session** **Computational Approaches in Neural Engineering** **Chairs:** James Weiland, (University of Michigan)	**BHI Special Session** **Challenges and opportunities in assessing biomarkers of mental states during cognitive demanding tasks** **Chairs:** Marco Simões, (University of Coimbra); Ricardo Couceiro, (University of Coimbra)	**BSN Special Session** **Open-source algorithms and tools for accelerating adoption of wearable technology in clinical research** **Chairs:** Shyamal Patel; Ryan McGinnis; Vrutangkumar Shah
18:10-18:40	**Keynote Lecture:** **"Large networks of disease-disease interactions at the medical and molecular level"** **Alfonso Valencia**, ICREA Research Professor and Director of the Life Sciences Department, Barcelona Supercomputing Centre, Spain Chair: Maria Fernanda Cabrera (Technical University of Madrid)			
18:40-19:00	**Closing Ceremony, Best Paper, Best Poster Awards**			

Keynote Speakers

Wearable “SUPER-MINDS” for the Precision Control of CVDs and COVIDs

Date: Wednesday, July 28, 2021

Time: 15:05-15:35

Prof. Yuan-Ting Zhang
Hong Kong Center for Cerebro-cardiovascular Health Engineering (COCHE), HK

Abstract: The cardiovascular diseases (CVDs) and coronavirus diseases (COVIDs) are the most current pressing health challenges globally today. This talk will attempt to address the grand challenges through the paradigm shift to Health Informatics and discuss the convergence approach to integrate technologies across multiple scales in the biological hierarchy from molecular, cell, organ to system for diseases prevention. The presentation will focus on the development of wearable ‘SUPER-MINDS’ technologies and their integrations with unobtrusive sensing, biomarker detection, biomedical imaging and machine learning for the early prediction of acute CVDs. Potential applications in the fast response and precise control of COVID-19 will also be discussed. Using the atherosclerotic plaque assessment as an example, this talk will illustrate that the health convergence approach should allow the practice of 8- P’s proactive medicine that is predictive, preventive, precise, pervasive, personalized, participatory, preemptive, and patient-centralized.

Bio: Dr. Yuan-Ting Zhang is currently the Chairman and Director/CEO of Hong Kong Center for Cerebro-cardiovascular Health Engineering (COCHE) at the HKSTP and the Chair Professor of Biomedical Engineering at City University of Hong Kong. He is a LRG member of Karolinska Institutet MWLC. He was the Sensing System Architect in Health Technology and Sensing Hardware Division at Apple Inc., California, USA, and the founding Director of the Key Lab for Health Informatics of Chinese Academy of Sciences. Professor Zhang dedicated his service to the Chinese University of Hong Kong from 1994 to 2015 in the Department of Electronic Engineering, where he served as the first Head of the Division of Biomedical Engineering and the founding Director of the Joint Research Center for Biomedical Engineering and developed the Bachelor, Master and PhD degree Programmes all in Biomedical Engineering.

Simplifying interpretation and acquisition of ultrasound scans

Date: Wednesday, July 28, 2021

Time: 15:55-16:25

Prof. Alison Noble
Professor in Biomedical Engineering, University of Oxford, UK

Abstract: With the increased availability of low-cost and handheld ultrasound probes, there is interest in simplifying interpretation and acquisition of ultrasound scans through deep-learning based analysis so that ultrasound can be used more widely in healthcare. However, this is not just “all about the algorithm”, and successful innovation requires inter-disciplinary thinking and collaborations.
In this talk I will overview progress in this area drawing on examples of my laboratory’s experiences of working with partners on multi-modal ultrasound imaging, and building assistive algorithms and devices for pregnancy health assessment in high-income and low-and-middle-income country settings. Emerging topics in this area will also be discussed.

Bio: Professor Alison Noble FRS is currently the Technikos Professor in Biomedical Engineering, at the University of Oxford, UK and former Director of the Oxford Institute of Biomedical Engineering (2012-16) and a former Associate Head of the Mathematical, Physical and Life Sciences Division (2016-19.)

Alison’s research focuses on ultrasound imaging, and computational analysis of images, motivated by unmet clinical needs in global healthcare settings. She received the Royal Society Gabor Medal for her inter-disciplinary research contributions in 2019, and the same year received the MICCAI Society Enduring Impact award. She is a current European Research Council Advanced Grant holder, and has held or currently holds grants from the UKRI, NIHR, Wellcome Trust, NIH, and the Bill and Melinda Gates Foundation. She has supervised 69 graduated PhD students (19 women), and has a sustained track record of mentoring early career researchers at Oxford and on national schemes.

Alison serves on numerous national and international advisory boards. She served on the MICCAI Society board for a decade and is a former President of the MICCAI Society (2013-5). She is an active Fellow of the Royal Academy of Engineering and of the Royal Society, and received an OBE for services to science and engineering in the Queen’s Birthday Honours list in June 2013.

Improving Consideration of Social and Cognitive Behaviors in Advancing Informatics Technologies for Health Care

Date: Thursday, July29, 2021

Time: 14:00-14:30

Prof. Vimla L Patel
Director of the Center for Cognitive Studies in Medicine and Public Health at the New York Academy of Medicine, USA

Abstract: The modern landscape is being shaped by complex converging forces that will cause shifts in how we deliver and use health care. As we embrace inevitable technological advances, social and cognitive factors will need to be a major part of the discussion, with a focus on the users of the technical innovations. Current efforts to advance this goal have already started. However, there is still a disparity between the users' knowledge and expectations of the technical systems being introduced and their lay beliefs, limited mental models of the technology, and their cognitive representations of illness and disease. Social cognition is predicated upon the belief that both patients and clinicians are predisposed to see the world in individualized ways that shape their behavior and decision-making. These factors are too often misunderstood or ignored in the design and evaluation of engineering systems. A major challenge for health informatics in the future will be to generate evidence-based information about how people process medical and health-related information, with and without supporting technologies. There will be a much greater need for collaborative efforts among scientists (biomedical, cognitive, and social), practitioners, and engineers, as they design and implement systems, if we are to offer technologies that are embraced and thereby reshape the future of our healthcare for a better quality of life. I will address some of these issues with examples from cognitive informatics studies, which influence users' behavior as they interact with health care technology.

Bio: Vimla L Patel is a Senior Research Scientist and Director of the Center for Cognitive Studies in Medicine and Public Health at the New York Academy of Medicine. She is also an adjunct Professor of Biomedical Informatics at Columbia University and the College of Health Solutions at Arizona State University (ASU). A graduate of McGill University in Montreal, Dr. Patel was a Professor of Medicine and Psychology and Director of McGill Cognitive Science Center. From 2007-2009, she served as the Professor and Chair of Biomedical Informatics in the Ira Fulton School of Engineering at ASU. Her early research related to cognitive mechanisms underlying expertise and medical decision-making. Her studies over the past two decades are on decision support technology and errors in complex clinical environments, addressing the role of cognition in biomedical informatics (human-computer interaction, cognitive design, distributed cognition, and team decision making) for a safer clinical workplace.

Soft, Wearable Systems with Integrated Microfluidics and Biosensors for Remote Health Monitoring

Date: Thursday, July 29, 2021

Time: 14:30-15:00

Prof. Roozbeh Ghaffari
Northwestern University, USA

Abstract: Soft bio-electronics and microfluidics, enabled by recent advances in materials science and mechanics, can be designed with physical properties that approach the mechanical properties of human skin. These systems are referred to as epidermal electronics and epifluidics by virtue of their stretchable form factors and soft mechanics compared to conventional packaged electronics and sensors. Here, we present an overview of recent advances in novel materials, mechanics, and designs for emerging classes of fully-integrated epidermal electronics and soft microfluidic systems. These devices incorporate arrays of sensors, microfluidic channels and biochemical assays, configured in ultrathin, stretchable formats for continuous monitoring of electro-chemical signals and biophysical metrics. Quantitative analyses of strain distribution and circuit performances under mechanical stress highlight the utility of these wearable systems in clinical and home environments. We will conclude with representative examples of these wearable systems, which have entered the commercialization phase of deployment.

Bio: Dr. Ghaffari is co-founder and CEO of Epicore Biosystems, Inc., a company developing a proprietary wearable microfluidic sensing platform. He also serves as an Associate Research Professor in the Department of Biomedical Engineering at Northwestern University, and is Director of Translational Research at the Querrey-Simpson Institute for Bioelectronics. Dr. Roozbeh Ghaffari holds BS and MEng degrees in electrical engineering from the Massachusetts Institute of Technology. He received his PhD in biomedical engineering from the Harvard Medical School-MIT Program in Health Sciences and Technology. Upon completion of his PhD, Dr. Ghaffari co-founded MC10 Inc (acquired by Medidata Inc), and served as Chief Technology Officer. In this role, Dr. Ghaffari led the development and commercial launch of the BioStamp health monitoring platform. Dr. Ghaffari's contributions in soft bioelectronics, micro/nano-scale systems, and auditory neuroscience research have been recognized with the Helen Carr Peake PhD Research Prize, MIT 100K Grand Prize, and MIT Technology Review Magazine's Top 35 Innovators Under 35. He has published over 100 academic papers and is inventor on over 50 issued patents.

Digital Health Technology – leveraging real-world insights in mobility

Date: Friday, July 30, 2021

Time: 14:00-14:30

Prof. Lynn Rochester
Newcastle University, UK

Abstract: Mobility is important – the last year has brought this into sharp focus. Mobility is not only a target for intervention, subtle features of mobility (such as how fast someone walks and how variable their steps are) provide us with a window into the brain and body and an indicator of health. As a clinician, mobility has been my focus. In particular, how do we keep people with neurodegenerative disease such as Parkinson's – mobile and safe? This propelled me towards the scientific study of gait – a key feature of mobility. The last 10 years have seen a revolution in digital technology (such as wearables and mobile devices) advancing the study of mobility. Implementing technology in the real-world allows further insights into health previously unobtainable and a 'living-lab' approach to study and treat mobility loss. Continuous monitoring captures the challenges of mobility that play out in real-time at the intersection between personal, contextual and environmental demands and bring a personalized focus to healthcare. However, large scale implementation of real-world mobility assessment and treatment, although promising, remains tantalizingly out of reach. This talk will focus on experiences and insights using digital technology to quantify mobility in Parkinson's disease, explore challenges to extract meaningful insights from continuous real-world mobility data, and highlight future possibilities. Throughout I will draw on my own experience using digital technology and leverage insights from the work of the Mobilise-D consortium (https://www.mobilise-d.eu/), a large international effort to translate real-world mobility assessment to research and healthcare.

Bio: Lynn Rochester is Professor of Human Movement Science at Newcastle University. She is the Specialty Cluster Lead for the National Institute for Health Research (NIHR) Clinical Research Network providing strategic oversight of research delivery in ageing, neurodegenerative disease, dementia, genetics and neurological disorders and, oversees the flagship NIHR-INCLUDE Project (https://sites.google.com/nihr.ac.uk/include/home). Lynn's research interests focus on understanding and mitigating mobility loss in ageing and neurodegenerative disease and, conversely, what mobility can tell us about brain health. To deliver these interests she leads the Brain and Movement Research Group (BAM) (http://bam-ncl.co.uk/) – comprised of a multidisciplinary team of clinicians, clinical and data scientists and clinical engineers. In recognition of her research leadership, she holds an NIHR Senior Investigators award.

Leveraging Electronic Health Records for Precision Health

Date: Friday, July 30, 2021

Time: 14:30-15:00

Prof. Marylyn D. Ritchie
Professor in the Department of Genetics, Director of the Center for Translational Bioinformatics, Associate Director for Bioinformatics in the Institute for Biomedical Informatics, University of Pennsylvania School of Medicine, USA

Abstract: Biomedical data science has experienced an explosion of new data over the past decade. Abundant genetic and genomic data are increasingly available in large, diverse data sets due to the maturation of modern molecular technologies. Along with these molecular data, dense, rich phenotypic data are also available on comprehensive clinical data sets from health care provider organizations, clinical trials, population health registries, and epidemiologic studies. The methods and approaches for interrogating these large genetic/genomic and clinical data sets continue to evolve rapidly, as our understanding of the questions and challenges continues to develop. Through applying bioinformatics, statistics, and machine learning approaches to the rich phenotypic data of the EHR, these data can be mined to identify new and interesting patterns of disease expression and relationships. We have been exploring various translational bioinformatics technologies for evaluating the phenomic landscape to improve our understanding of complex traits. These techniques show great promise for the future of precision medicine and precision health.

Bio: Marylyn D. Ritchie, PhD is a Professor in the Department of Genetics, Director of the Center for Translational Bioinformatics, Associate Director for Bioinformatics in the Institute for Biomedical Informatics at the University of Pennsylvania School of Medicine. Dr. Ritchie is also Associate Director for the Penn Center for Precision Medicine. Dr. Ritchie is a translational bioinformatics scientist, biomedical informatician, and computational human geneticist with a focus on developing novel approaches for understanding the relationship between our genome and human phenotypes. Dr. Ritchie has over 20 years of experience in the analysis of complex data and has authored over 350 publications. Dr. Ritchie has received several awards and honors including selection as a Genome Technology Rising Young Investigator in 2006, an Alfred P. Sloan Research Fellow in 2010, a KAVLI Frontiers of Science fellow by the National Academy of Science from 2011-2014, and she was inducted as a fellow of the American College of Medical Informatics in 2020. Dr Ritchie is also the host of two podcasts: she co-hosts The Biomedical Informatics Roundtable podcast with Dr. Jason Moore and she is the solo host of The CALM Podcast: Combining Academia and Life with Marylyn.

Large networks of disease-disease interactions at the medical and molecular level

Date: Friday, July 30, 2021

Time: 18:10-18:40

Prof. Alfonso Valencia
ICREA Research Professor and Director of the Life Sciences Department, Barcelona Supercomputing Centre, Spain

Abstract: Biomedicine is confronting significant challenges for the handling and analysis of large data sets, among them a particularly relevant one is the interaction between diseases, i.e. disease comorbidities. Comorbidities are an important medical and social problem that demands an interpretation of the underlying physiological causes, as a necessary step to progress in its management and control. As a first step in this direction, we have analysed two complementary data sets, one composed by a large collection of expression data (RNAseq data 72 human diseases analysed by 107 studies, including a total number of 4.267 samples, from the GREIN platform) the other one base on medical records from three different medical systems (Blumenau, Brazil; Catalonia, Spain; and Indianapolis, United States) or from previous publications (Hidalgo *et al.* 2009 and Jensen *et al.* 2014). With this information, we have constructed two disease-disease interaction networks, one reflecting real-world medical associations and the other the similarities of the molecular profiles of patients of different diseases. Interestingly, the two networks have striking similarities in terms of their organization and characteristics. More importantly, we can show for the first time that most disease interactions have a counterpart at the molecular level. This molecular relationship can be translated into detailed molecular basis of specific disease interactions. I will discuss the implications of these results for the interpretation of diseases interactions at the level of specific genes and pathways, as well as the potential consequences for the management of disease comorbidities.
Based on the work of: Beatriz Urda-García, Jon Sanchez, Rosalba Lepore at BSC.

Bio: Alfonso Valencia is a Biologist by training with a Ph.D. in Biochemistry and Molecular Biology by the Universidad Autónoma de Madrid. He is ICREA Research Professor and Director of the Life Sciences Department at the Barcelona Supercomputing Centre (BSC), Director of the Spanish National Bioinformatics Institute (INB) and head of the Spanish Node of the European Bioinformatics Infrastructure ELIXIR. He is a member of the European Molecular Biology Organisation (EMBO), and former President of the International Society for Computational Biology (ISCB). He was honoured as ISCB-Fellow in 2010.

Clinical/Translational Panel

Advances and Trends in use of Informatics in Clinical Practice

Chair: Athanasios Tzioufas, National and Kapodistrian University of Athens, Greece

Date: Wednesday, July 28, 2021

Time: 16:30-17:30

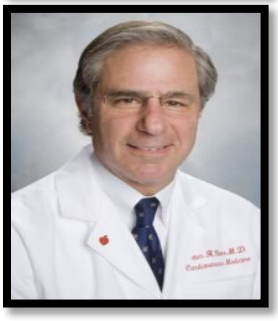
Doris-Eva Bamiou, Professor in Neuroaudiology – UCL Ear Institute, UK
Title of Presentation: Trends in telerehabilitation for balance patients

Elazer R. Edelman MD PhD FACC, Edward J. Poitras Professor, Medical Engineering and Science, Director, Institute for Medical Engineering and Science, Massachusetts Institute of Technology, Professor of Medicine, Harvard Medical School, Senior Attending Physician, Brigham and Women's Hospital, USA

Title of Presentation: In Silico Medicine: AI in Cardiovascular Devices – Evolution / Revolution
Elazer R. Edelman, is the Director of the Institute of Medical Engineering and Science at the Massachusetts Institute of Technology where he is also Director of the Clinical Research Center, and the current occupant of the Edward J. Poitras Chair as Professor of Medical Engineering and Science. At Harvard Medical School he is Professor of Medicine, and Senior Attending Physician in the cardiac intensive care unit at Brigham and Women's Hospital.

Maria Teresa Arredondo, Universidad Politécnica de Madrid, Spain
Title of Presentation: Towards data driven decision making in clinical practice for better health and well-being

Norbert Graf, Saarland University, Dep. Pediatric Oncology and Hematology, Germany
Title of Presentation: View on clinical informatics from a clinical perspective



Peter Stone, MD, Director, Vascular Profiling Research Group, Division of Cardiovascular Medicine, Brigham & Women's Hospital, Harvard Medical School, Boston, MA, USA

Title of Presentation: Coronary Plaque Anatomic and Biomechanical Variables Are Synergistic for Prognostication of Individual Plaque Progression, Destabilization, or Quiescence: Mechanisms and Detection

Regulatory Panel

Regulatory issues for medical devices

Chair: Nenad Filipovic, University of Kragujevac, Serbia

Date: Thursday, July 29, 2021

Time: 15:05-16:05

Kevin Fu, Center for Devices and Radiological Health (CDRH), Office of Strategic Partnerships and Technology Innovation (OST), U.S. Food and Drug Administration

Title of Presentation: Medical Device Security, USA

Kevin Fu is Associate Professor of EECS at the University of Michigan where he directs the Security and Privacy Research Group (SPQR.eecs.umich.edu). During 2021, Fu is also Acting Director of Medical Device Cybersecurity at FDA's Center for Devices and Radiological Health (CDRH) and Program Director for Cybersecurity, Digital Health Center of Excellence (DHCoE). He is most known for the original 2008 cybersecurity research paper showing vulnerabilities in an implantable cardiac defibrillator by sending specially crafted radio waves to induce uncontrolled ventricular fibrillation via an unintended wireless control channel. https://www.secure-medicine.org/hubfs/public/publications/icd-study.pdf The prescient research led to over a decade of revolutionary improvements at medical device manufacturers, global regulators, and international healthcare safety standards bodies just as ransomware and other malicious software began to disrupt clinical workflow at hospitals worldwide.

Kevin was recognized as an IEEE Fellow, Sloan Research Fellow, MIT Technology Review TR35 Innovator of the Year, Fed100 Award recipient, and recipient of an IEEE Security and Privacy Test of Time Award. Fu has testified in the U.S. House and Senate on matters of information security and has written commissioned work on trustworthy medical device software for the U.S. National Academy of Medicine. He co-chaired the AAMI cybersecurity working group to create the first FDA-recognized standards to improve the security of medical device manufacturing. He founded the Archimedes Center for Healthcare and Device Security (secure-medicine.org). He is a founding member of the N95decon.org team for emergency reuse decontamination of N95 masks during PPE shortages. Fu served as a member of the U.S. NIST Information Security and Privacy Advisory Board and federal science advisory groups. Eleven years ago, Fu served as a visiting scientist at the U.S. Food & Drug Administration. Fu received his B.S., M.Eng., and Ph.D. from MIT. He earned a certificate of artisanal bread making from the French Culinary Institute and is an intermediate level salsa dancer.

Nicholas Petrick, U.S. Food and Drug Administration, Center for Device and Radiological Health, USA

Title of Presentation: A brief introduction to medical device regulation

Nicholas Petrick is Deputy Director for the Division of Imaging, Diagnostics and Software Reliability at the Center for Devices and Radiological Health, U.S. Food and Drug Administration and is a member of the FDA Senior Biomedical Research Service. The Division of Imaging, Diagnostics and Software Reliability Division conducts regulatory research in medical imaging physics and image analysis techniques to optimizing medical image interpretation. Dr. Petrick received his Ph.D. from the University of Michigan in Electrical Engineering-Systems and is a Fellow of the Americana Institute of Medical and Biomedical Engineering and SPIE. His current research focuses on quantitative imaging, medical artificial intelligence and the robust assessment methods for a range of medical imaging hardware systems and medical artificial intelligence tools.

Yiannos Tolias, Legal Lead AI and AI liability in healthcare, DG SANTÉ, European Commission, Belgium

Title of Presentation: Challenges in developing and deploying AI in healthcare

Yiannos is a legal lead on AI liability and AI in healthcare in DG SANTE (Health and Food Safety) in the European Commission. He was a Senior Emile Noel Fellow at NYU Law School working on a project on machine learning in medicine and law. Prior to joining the European Commission, he was an Assistant Professor of EU law at the Universities of Edinburgh and Dundee. He holds a Ph.D. in EU Constitutional law from the University of Edinburgh and was a Post-doctoral Research Fellow at the Institute for Advanced Studies in the Humanities (Edinburgh University).

Andreas Melzer, University of Leipzig, Germany

Industry Panel

The Evolution of AI products/services in medical informatics

Chair: Chair: Julien Penders, Bloomlife, USA

Date: Friday, July 30, 2021

Time: 15:05-16:05

Andreas Persidis, CEO, Bioviasta Inc., Greece, USA

Title of Presentation: Augmented Network Intelligence in support of complex medical challenges

Christine Miyachi, IEEE Future Directions Committee Chair, USA

Title of Presentation: Learn how Nuance is using AI to help solve sub-optimal patient care, clinician burnout and missed reimbursement and financial pressures by automating Electronic Health Record creation.

Christine Miyachi is an experienced software architect and technical manager, and her career spans working for large companies like Xerox, and several startups. She is a Software Development Manager at Nuance Communications where she works on AI systems for healthcare. After serving several leadership and editorial roles at the IEEE, she currently is chair of IEEE Future Directions Committee (https://www.ieee.org/about/technologies.html). In addition, she writes a blog about software architecture: http://abstractsoftware.blogspot.com/. Miyachi graduated from the University of Rochester with a BS in electrical engineering. She holds two MIT degrees: an MS in technology and policy/electrical engineering and computer science and an MS in System Design and Management. See more about Chris at www.christinemiyachi.com

Hosain Rahman, Jawbone Health, USA

Title of Presentation: Integrated Continuous Monitoring

Hosain Rahman is the CEO and Founder of all.health. All.health is delivering the world's leading end-to-end proactive and preventative healthcare platform using continuous health information combined with human and machine intelligence.Previously Hosain was the CEO and Co-Founder of Jawbone, a world-leader in consumer technology products, where he led the creation of several large new categories through the industry defining products including the world's first smart Bluetooth headset, the Jawbone headset, the world's first, mobile wireless smart speaker, the JamBox, and the world's first wrist-based wearables, the UP line of health trackers. Hosain has been honored in: Fast Company's Most Creative People, Vanity Fair's New Establishment, and Fortune's 40 Under 40. In 2014 he was named a Young Global Leader by the World Economic Forum and was named one of Time Magazine's 100 most influential people in the world.

Ilkka Korhonen, Firstbeat Technologies Oy, Jyväskylä, Finland; and Tampere University, Tampere, Finland

Title of Presentation: Supporting employee health with wearable data and intelligent analytics

CTO at Firstbeat Technologies Ltd. >30y expertise in HealthTech, wearables, algorithms and sensing technology, research and translating research into products, partner relations and business development. Passionate health tech pioneer committed to make the consumer as a central user of health information and to use health tech to transform our behaviors to promote health and happiness. Also, earlier, scientific research as a professor in ICT for health with special focus on personal health systems, eHealth/mHealth, biosignal interpretation, health monitoring and wearable health sensors, and even decision making based on sensor data in critical care and anesthesia. Several patents and inventions, contribution to several product launches and business and concept design of commercialized products even during research years. >20y experience in management of relations to international industrial partners (IT, medical technology, ODM/OEM) and health and social care partners (hospitals, healthcare and research institutions). Special strengths in multidisciplinary collaborating, strong and proven ability to efficiently manage and inspire complex networks of divergent skills. >200 international scientific publications, founding member of IEEE EMBS TC on Wearable Biomedical Sensors and Systems, member of IEEE EMBS TC for Biomedical and Health Informatics, and Senior Member in IEEE EMBS.

Ming Jack Po, MD, PhD, CEO and founder of Ansible Health

Title of Presentation: Does AI matter in medicine?

Ming Jack Po, MD, PhD, is the CEO and founder of Ansible Health, a venture-backed startup focused on home based chronic care management, starting with COPD. Prior to his current role, he was a product manager at Google working in Healthcare and Machine Learning. At Google, he has led teams in Health, Research, Cloud, as well as in Search. Prior to joining Google, Jack spent a decade working in different senior operating and venture capital roles in areas related to medical devices, healthcare delivery, and Global Health. Jack is a respected thought leader in the fields of Healthcare IT, Healthcare Delivery, Machine Learning, and BioDesign and he continues to teach and mentor students at Columbia University and Johns Hopkins University. In addition, Jack is currently a board member of El Camino Health System, a trustee of the Austen Riggs Center, a board member of AcademyHealth, a member of the NIH's National Library of Medicine's Board of Scientific Counselors, and a member of the ONC's Interoperability Standards Priorities Task Force.

Jack received his M.D. and Ph.D. from Columbia College of Physicians and Surgeons and from the Department of Biomedical Engineering at Columbia University's Fu School of Engineering. He received his M.A. in mathematics, and his B.S. in Biomedical Engineering and Computer Science from Johns Hopkins University.

Featured Session

Pandemic Mitigation by Modeling and Informatics: Lesson Learned from COVID-19

Chair: Constantinos S. Pattichis, Univ. of Cyprus, Cyprus

Date: Wednesday, July 28, 2021

Time: 17:30-18:00

Prof George Panos, BSc(Biomed. Eng.), CEng, MIET, MD, PhD, DTM&H(Lon), FRCP. Former Professor, Internal Medicine, School of Medicine of the University of Cyprus and at the Nicosia General Hospital Internal Medicine Clinic, USA

Title of Presentation: Technological Challenges to assist in the clinical management towards the Pandemic Response

Abstract: COVID-19 pandemic created tremendous pressure of patient load on the health systems and especially in hospitals challenging their ability to effectively monitor COVID-19 inpatients disease progression and provide the appropriate treatment in a timely manner. Approximately 4% of COVID 19 positive patients need hospitalization and of these an estimated 2.5% end up in ICUs and Units for Special Care. Technological challenges to record and manage the mounting epidemiological and clinical data which ultimately translated to patients' health, inevitably led to the design and implementation of a unified electronic surveillance and management platform almost immediately by the medical and engineering community that ingeniously utilized technological devices and IT solutions to deliver a real time web based covid-19 electronic health record. This covid-19 eHealth platform is categorized in three main sections a) Demographics, allergies, comorbidities, symptoms and date of symptoms onset including a self-assessment of symptom severity development by time and date, vital signs, oxymetry, current medication b) Hospital admission details (bed/ward/department), patient summary and continuous cumulative graph depictions of vital signs, oxygen status (oximetry SpO2/FiO2 and/or blood gases pO2/FiO2) and scoring systems (e.g. Acute Respiratory Distress Syndrome, Modified Early Warning System and Glasgow Coma Scale), ECG-QTc estimation c) Daily comprehensive real-time web based COVID-19 electronic health record (patient history, clinical examination, lab exams, treatment regimens) with simple timeline statistical permutation depictions.

Professor Joshua S Weitz, Tom and Marie Patton Professor of Biological Sciences, Georgia Institute of Technology, USA

Title of Presentation: Modeling, Interventions, and the Ongoing Need for Pandemic Response and Mitigation Instruments

Abstract: The Covid-19 pandemic continues to impact the health and well-being of communities all across the globe. From the outset, epidemic theory and models have played a key role in advancing understanding of the potential threat and in shaping public health responses. In this talk, I will highlight both near- and long-term challenges in controlling Covid-19. In doing so, I will focus on efforts to characterize non-canonical features of spread (including gathering-associated risk, behavioral feedback, and the impacts of heterogeneity) as well as efforts to use testing (including PCR and serological tests) as a means to mitigate and control spread. In closing, I will also highlight lessons learned and ongoing opportunities for use-inspired theory and modeling initiatives to enhance response, decision-making, and mitigation instruments.

IEEE BHI-BSN 2021 Workshops

All workshops will be held on Tuesday, July 27, 2021.

Title: Assessing credibility of *in silico* trials for regulatory purposes

Organizers: Marco Viceconti, University of Bologna, Italy; Liesbet Geris, University of Liege, Belgium

Short Description: The use of modelling and simulation to evaluate the safety and efficacy of new medical products, usually referred to as In Silico Trials, is moving from the research labs to a concrete industrial reality. Probably the biggest barrier in this translation from research to innovation is the lack of a specific regulatory science to evaluate the credibility of this predictive model when used to assess medical products such as drugs or medical devices. This workshop provides an update on the latest developments in the field, by some of the leading experts.

Title: Trends, challenges and opportunities for the Hospital of the Future

Organizers: Maria Teresa Arredondo and Giuseppe Fico, Universidad Politécnica de Madrid (UPM), Spain

Short Description: New global challenges are demonstrating that high levels of collaboration are required for interconnected societies to face emergencies and crisis. In this context, rethinking and reshaping the role of hospitals as physical and virtual spaces is a fundamental need that National Healthcare System are called to lead. However, hospital management is not data-driven yet, clinical and logistic processes work substantially in silos.

Title: Big data and artificial intelligence in cancer imaging

Organizers: Prof. Karim Lekadir, Universitat de Barcelona, Spain; Prof. Luis Martí-Bonmatí, La Fe University, Spain; Prof. Manolis Tsiknakis, FORTH, Greece; Mrs. Gianna Tsakou, Athens R&D Lab of Maggioli S.P.A., Italy

Short Description: Artificial Intelligence (AI) offers substantial opportunities for healthcare, supporting better diagnosis, treatment, prevention and personalised care. Analysis of health images is one of the most promising fields for applying AI in healthcare, contributing to better prediction, diagnosis and treatment of cancer. In order to develop and test reliable AI applications in the field, access to large-volume of high- quality data is needed.

The organizers of the workshop are the coordinators of the four projects that have recently been funded by the EC in the context of a relevant H2020 call (H2020-SC1-FA-DTS-2019-1 – AI for Health Imaging) CHAIMELEON (https://chaimeleon.eu/), EuCanImage (https://eucanimage.eu/), INCISIVE (https://incisive-project.eu/), ProCancer-I (https://www.procancer-i.eu/) and the PRIMAGE (https://www.primageproject.eu/) a relevant R&D project funded in a previous H2020 call.

The projects are seeking to establish large interoperable repositories of health images, enabling the development, testing and validation of AI–based health imaging solutions to improve diagnosis, disease prediction and follow-up of the most common forms of cancer. The ongoing collaboration and information exchange among the projects so far has highlighted several areas where common approaches and consensus building should be seeked by the five projects and even beyond by the wider scientific community, in order to achieve interoperability. Similarly, it has led to the identification of significant technical and methodological challenges that need to be addressed in designing and exploiting such interoperable cancer imaging data spaces.

The workshop will provide a detailed report of the collaboration opportunities and challenges identified so far; it will also present current approaches towards consensus building and critically discuss alternatives. Particular emphasis will be given to the issues related to the evaluation of AI-based diagnostic imaging algorithms including robustness, trust and explainability.

Title: Integrating Gender perspective in Science, Technology and Innovation

Organizers: Maria Fernanda Cabrera-Umpierrez, Life Supporting Technologies – Universidad Politecnica de Madrid (Spain); Yolanda Ursa, INMARK, Spain

Short Description: The goal of this workshop is to address the challenge of integrating the gender perspective in science, technology, and innovation (STI) in international cooperation and work towards gender equality discussing about a strategy to promote equality in scientific careers, gender balance in decision making and the integration of the gender dimension in R&I content.

IEEE BHI-BSN 2021 Workshops

All workshops will be held on Tuesday, July 27, 2021.

Title: Machine Learning based decision support system for early-stage prediction of complications and risk stratification of COVID 19 patients

Organizers: Luca Romeo, Michele Bernardini, Emanuele Frontoni, Dep. of Information Engineering (DII), Università Politecnica delle Marche, Ancona (Italy); Jonathan Montomoli, Dep. of Intensive Care, Hospital Infermi, Rimini Dep. of Intensive Care Medicine, Erasmus medical Center, Rotterdam, Netherlands; Maggie Cheng, Illinois Institute of Technology, USA; Farshad Firouzi, Duke University, USA

Short Description: During the COVID-19 emergency, intensive care achieved its limit, and the doctors were forced to choose their ICU patients who have the best chance for survival. This worldwide emergency highlighted the need to define a predictive care model capable of providing an accurate estimate of resources and preventive medicine. The analytical capability of machine learning (ML) methods has proven to be extremely accurate and in some cases superior to classical statistical approaches for solving this task. This WS aims to cover all aspects related to ML methodologies for providing risk profiles of the individual patients from which a different intensity of care can be deduced.

Title: Real-world digital mobility assessment

Organizers: Andrea Cereatti, Politecnico di Torino, Italy; Silvia Del Din, Newcastle University, UK; Felix Kluge, Friedrich-Alexander University Erlangen-Nürnberg, Germany

Short Description: Mobility is impaired in various chronic health conditions. The ongoing development of digital measures for mobility assessment using wearable inertial sensor systems aims at capturing real-world walking performance. This enables monitoring of health status, disease progression, and evaluation of interventions in a patient's ecological environment. However, walking assessment in non-standardized environments poses challenges in terms of technology, usability, and validity of digital measures that can be used for disease stage quantification with the ultimate goal of regulatory approval.

Title: AI4US: Unlocking the potential of Artificial Intelligence for Ultrasound image processing

Organizers: Sara Moccia, PhD – The BioRobotics Institute and Department of Excellence in Robotics and AI, Scuola Superiore Sant'Anna, Pisa, Italy; Prof. Emilio Filippucci, MD, PhD – Rheumatology Unit, Department of Clinical and Molecular Sciences, "Carlo Urbani" Hospital, Jesi, Italy; Maria Chiara Fiorentino – Department of Information Engineering, Università Politecnica delle Marche, Ancona, Italy; Prof. Emanuele Frontoni, PhD – Department of Information Engineering, Università Politecnica delle Marche, Ancona, Italy

Short Description: The goal of the AI4US workshop is to group expert AI researchers in US-image analysis to discuss the most recent research work and highlight current challenges and needs. AI4US aims at bridging the gap among universities, hospitals, enterprises, and stakeholders to draw a roadmap for future AI applications in the field.

The intended audience of AI4US ranges from PhD students and resident doctors that are approaching the challenges of US image analysis with AI, to experienced researchers that may be interested in knowing the latest breakthrough research. Graduate students in biomedical engineering, computer science and medicine may benefit from the invited speakers' presentations highlighting the current research work being done on AI for US image analysis.

Title: Soldier Digital Phenotyping

Organizers: Karl E. Friedl & Reed W. Hoyt, U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts, USA

Short Description: Real time physiological monitoring of individual soldiers (digital phenotyping) provides actionable information from wearable sensors, standoff detection, and contextual data (internet of soldier things) to inform virtual teammates (humanized technology), protect soldier health and performance, and provide decision support tools. The development of sensor systems and algorithms for use in extreme and austere environments will be discussed.

Title: Predicting quality of life with multimodal data

Organizer: Valeria De Luca, Novartis Institutes for Biomedical Research, Switzerland; Ieuan Clay, Evidation Health, USA

Short Description: The field of digital health has become a multi-billion-dollar market, powering a paradigm shift in the continuous capture of multimodal data including activity, sleep, heart rate variability and contextual information. Novel machine learning applications are pioneering the conversion of these multimodal data into measures of quality of life, capturing symptoms like fatigue, stress, and depression. These insights will result in better understanding of the patient's lived experience and better medicines.